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(19) (CA) **CANADIAN PATENT** (12)

(54) MUFFLER

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ABSTRACT OF THE DISCLOSURE

An oil separator and muffler for use on the outlet of a compressor in a refrigerator. There is a chamber having an inlet to compressed refrigerant from the compressor. A perforate filter member in the chamber allows the refrigerant to pass. The member is able to remove non-gaseous impurities in the refrigerant. The perforate member is disposed to define downwardly inclined pathways in the chamber whereby liquid impurities can run downwardly to the bottom of the chamber. There is an outlet in the chamber for refrigerant that has passed through the perforate member and a drain in the base of the chamber for impurities gathered in the base of the chamber to be removed. The device acts as a muffler, vibration dampener and oil remover.

This invention relates to an oil separator, vibration dampener and muffler for use on the outlet of a compressor in a refrigeration system.

In any compression refrigerator, domestic or commercial, or in an icemaking system for, for example, ice
5 rinks the compressor is a simple piston and cylinder arrangement in which the piston is driven in the cylinder by a compressor motor, electrical or internal combustion. The refrigerant passes through the cylinder and is compressed
10 there by the piston. It is later liquefied in the condenser.

The noise produced by the compressor is substantial and must be muffled. The compressed refrigerant vapour leaving the compressor often includes oil introduced from
15 the compressor crankcase, and, as with any reciprocable engine, vibration is induced by the compressor.

Prior art treatment has largely concentrated on muffling the noise, typically by using a sound absorbing chamber with little function in removing oil or vibration.
20 However, the present invention provides an apparatus able to reduce the noise in refrigerator compressor to a satisfactory, acceptable level, to reduce the vibration, and to extract and separate oil from the compressed refrigerant.

Accordingly, in its broadest aspect, the present
25 invention is an oil separator and muffler for use on the outlet side of a compressor and comprising: a chamber having an inlet to receive compressed refrigerant from the compressor; a perforate filter member in said chamber through which the refrigerant can pass, said member being able to
30 receive non-gaseous impurities in said refrigerant; the

perforate member defining a plurality of downwardly inclined pathways in the chamber whereby liquid impurities can run downwardly to the bottom of the chamber; outlet means in the chamber for refrigerant that has passed through the perforate member; and a drain in the base of the chamber for impurities gathered in the base of the chamber to be removed.

The perforate member is desirably a rolled sheet of a mesh comprising a plurality of strands, each strand shaped and arranged to engage, at alternating joints, with both neighbouring strands and in which each series of alternating joints is generally in alignment. By this means the liquid and solid content of the refrigerant, for example oil and solid particles entrained by the oil or the refrigerant, are first removed by the mesh and then may run down the mesh towards the drain in the base of the chamber down the large number of roughly spiral pathways defined by each strand.

Desirably the column is a pipe extending into the chamber from the chamber inlet to adjacent the chamber outlet. There are openings in the pipe, adjacent the inlet, to allow the refrigerant to pass through the pipe into the chamber.

The drain is desirably provided with a valve, typically a ball float valve, so that the oil gathered in the base of the chamber may be withdrawn periodically. A passageway for manual withdrawal of oil and for purging may also be provided.

Aspects of the invention are illustrated, merely by way of example, in the accompanying drawings, in which:

Figure 1 is a sectional view through a muffler according to the present invention;

Figure 2 is a section on the line 2-2 in Figure 1;

Figure 3 is a section on the line 3-3 in Figure 1;

5 Figure 4 is a section on the line 4-4 in Figure 1;

Figure 5 is a section on the line 5-5 in Figure 1;

and

Figure 6 is a plan view of a perforate filter member.

10 The drawings illustrate an apparatus 2 to act as an oil separate muffler on the outlet side of a refrigerant compressor (not shown). The apparatus comprises a vessel 4 having a first opening 6 and a second opening 8 in opposed ends 10 and 12 respectively. The first opening 6 acts as in
15 inlet, the second opening 8 acts as an outlet.

There is a pipe 14 extending into the vessel 4 through the inlet 6 to stop short of the outlet 8. Perforate baffles 16 and 18 divide the vessel 4 into an inlet compartment 20, adjacent the first opening 6, an outlet
20 compartment 22, adjacent the second opening 8 and an intermediate compartment 24, between the inlet and outlet compartments 20 and 22. The baffles have openings 26 in them.

There are outlets 28 in the pipe 14. The outlets are in the inlet compartment 20 and have the form of elongated slits arranged around the pipe 14 - see Figures 1 and
25 5. There is a first drain 30 in the inlet compartment 20. The drain 30 has a valve 32. There is a second drain 42 with a valve 44.

A perforate filter material 34 in the form of a
30 metallic mesh, described later, is arranged in the inter-

mediate compartment 24 and is positioned to form a plurality of downwardly extending pathways. A plate 35 acts as a baffle to close off the top of the pipe.

Figure 6 shows a preferred configuration for mesh 34. The mesh comprises a plurality of strands 36 each formed into a series of loops. Each strand 36 then engages both neighbouring strands 36 at a series of alternate joints 38 and 40. Joints 38 are generally aligned with each other. Joints 40 are generally aligned with each other.

The strands form a series of spiral pathways. To introduce the mesh 34 into compartment 24 the mesh is rolled into a cylinder then positioned in compartment 24 around pipe 14.

In use the illustrated device 2 is bolted directly onto the outlet side of a refrigerator compressor. The compressor refrigerant moves up the pipe 14. Some of the refrigerant flows to the top of the pipe 14 where it is stoped by the baffle 35 and forced downwardly to pass through the outlets 28 in the inlet compartment 20. This change in direction of flow of the refrigerant and the pressure drop as it passes from the pipe 14, through the outlets 28, precipitates much of the oil suspended, The refrigerant then rises upwardly through the first perforate baffle 16, through the mesh 34, through the second perforate baffle 18 to the outlet compartment 22 and then through the outlet 8. In passing through the mesh 34 in particular the majority of the remaining oil in the refrigerant is filtered from it and flows downwardly along the spiral pathways defined by the strands of the perforate filter material. The oil passes

through the holes 26 in the first baffle 16 into the inlet compartment 20. In the inlet compartment 20 the oil is drawn off through drain 42 and may be returned to the crankcase. First drain 30 may be used to draw off oil from
5 compartment 20 manually or may be used to purge the apparatus.

In use, the present invention has been found to have about 35 to 40% better dampening or muffling of the exhaust noise than a conventional muffler. Furthermore, it
10 has been found that vibration on a compressor has been reduced to such a level that it is possible to balance a coin on its edge on top of a compressor when the compressor is fully loaded and at its maximum speed.

The apparatus is made of metal. Baffles 16 and
15 18 may be of expanded metal.

The present invention thus provides a simple yet extremely efficient muffler that also acts as an oil separator and vibration damper.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:-

1. An oil separator and muffler for use on the outlet of a refrigerator compressor and comprising:

a chamber having an inlet to receive refrigerant from the compressor;

a perforate filter member in said chamber through which the refrigerant gas can pass, said member being able to remove non-gaseous impurities from said refrigerant;

the perforate member being disposed to define a plurality of downwardly inclined pathways in the chamber whereby liquid impurities can run downwardly to the bottom of the chamber;

outlet means in the chamber for refrigerant that has passed through the perforate member; and

a drain in the base of the chamber for impurities gathered in the base of the chamber to be removed.

2. Apparatus as claimed in claim 1 in which the perforate member comprises a sheet of a mesh whose strands are arranged in a generally spiral pathway around a column within the chamber.

3. Apparatus as claimed in claim 2 in which the column is located by support members attached to the chamber but able to allow refrigerant to pass by them.

4. Apparatus as claimed in claim 3 in which the support members are discs to contact the column at their centers;

openings formed in the discs to allow refrigerant

to pass through them.

5. Apparatus as claimed in claim 2 in which the perforate member comprises a rolled sheet of mesh comprising a plurality of strands, each strand shaped and arranged to engage at alternating joints with each neighbouring strand and in which each series of alternating joints is generally in alignment.

6. Apparatus as claimed in claim 2 in which the column is a pipe extending into the chamber from the chamber inlet to adjacent the chamber outlet;

openings in the pipe, adjacent the inlet, to allow refrigerant to pass through the pipe to the chamber.

7. Apparatus as claimed in claim 1 in which the drain is provided with a valve.

8. Apparatus as claimed in claim 7 in which the valve is a ball float valve.

9. Apparatus to act as an oil separator and muffler on the outlet side of a refrigerator compressor, the apparatus comprising a vessel having first and second openings in opposed ends, the first opening to act as an inlet, the second to act as an outlet;

a pipe extending into the vessel through the inlet to stop short of the outlet;

perforate baffles to divide the vessel into an inlet compartment, adjacent the first opening, an outlet compartment, adjacent the second opening, and an intermediate compartment between the inlet and outlet compartments;

outlets in the pipe in the inlet compartment;

a drain in the inlet compartment;

perforate filter material arranged in the intermediate compartment to form a plurality of downwardly extending pathways whereby;

refrigerant entering the apparatus can flow upwardly through the pipe, through the outlets in the pipe into the inlet compartment, upwardly through the perforate baffles and the perforate filter material and out of the apparatus, entrained liquids and solids within the refrigerant being removed first by the expansion into the inlet chamber and, secondly, by the passage of the refrigerant through the filter member, material gathered by the filter member flowing downwardly into the inlet compartment where it is removed through the drain.

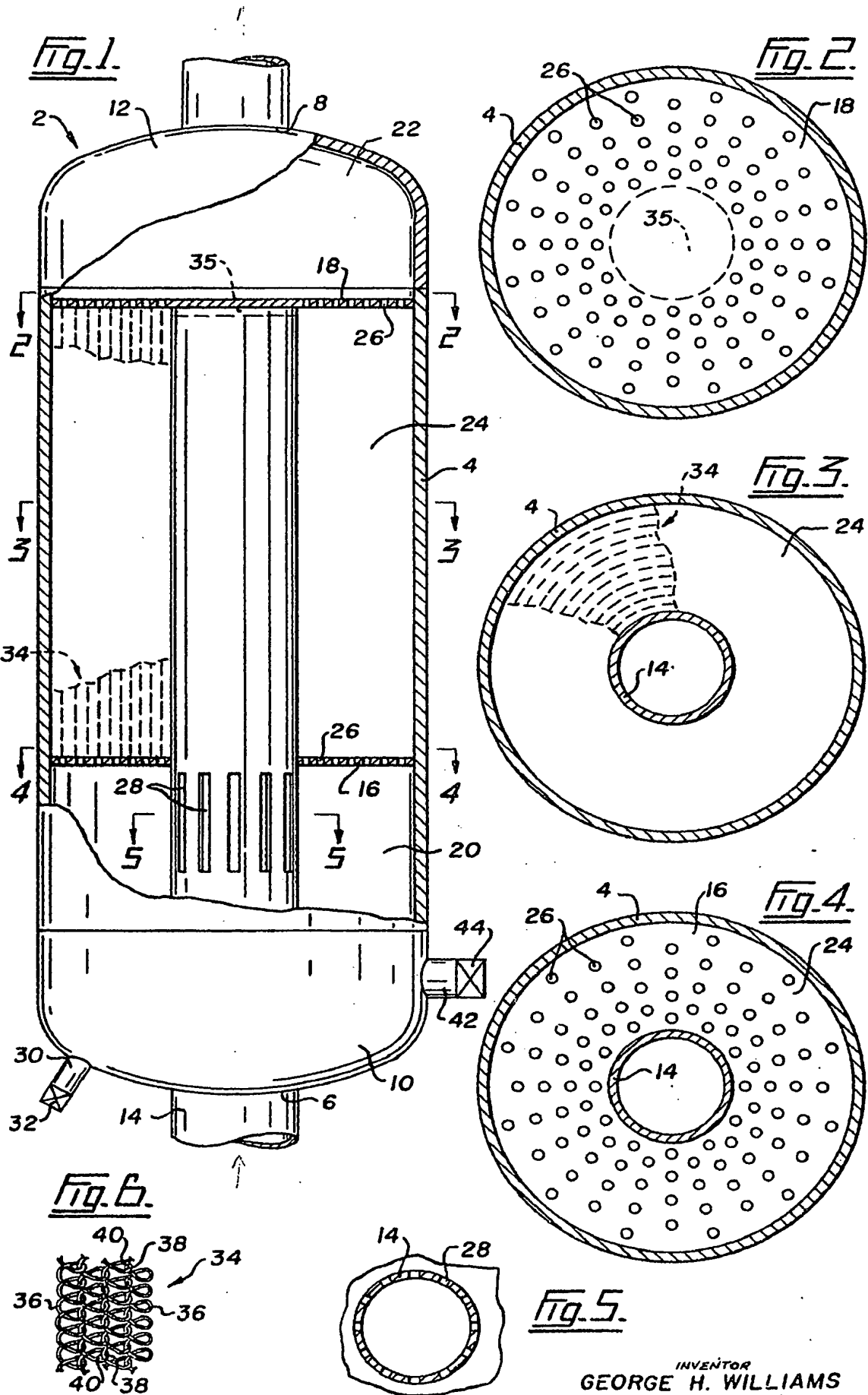
10. Apparatus as claimed in claim 9 in which the perforate filter material comprises a metallic mesh arranged around the pipe and extending outwardly to contact the interior of the vessel to define a plurality of spiral pathways.

11. Apparatus as claimed in claim 10 in which the perforate filter material comprises a rolled sheet of mesh comprising a plurality of strands, each strand shaped and arranged to engage at alternating joints with each neighbouring strand and in which each series of alternating joints is generally in alignment.

12. Apparatus as claimed in claim 9 in which the perforate baffles are discs attached to the pipe and to the vessel.

13. Apparatus as claimed in claim 9 in which the drain has a valve to control the drainage of oil.

14. Apparatus as claimed in claim 9, including a purge opening in the inlet compartment.



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